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Two new species of Trichoceridae from the Middle Jurassic Jiulongshan Formation of Inner Mongolia, China

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Abstract

Two new species, *Eotrichocera* (*Archaeotrichocera*) *longensis* **sp. n.** and *Eotrichocera* (*Archaeotrichocera*) *amabilis* **sp. n.** of Trichoceridae are described based on a combination of the following characters: Sc ending proximad of the forking of R_2, shape of d cell and A_2 rather short and bending sharply toward posterior margin. These fossil specimens were collected from the Middle Jurassic Jiulongshan Formation of Daohugou in Inner Mongolia, China.

Keywords

Diptera, *Eotrichocera*, *Archaeotrichocera*, Fossil, Daohugou

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Introduction

Trichoceridae is a family of medium-sized dipterans, commonly called winter crane flies, Yang and Yang (1995) found that just a few adults can live in cold environment, even in winter, and indicated that the name of winter crane flies might not be proper. However, the adults (include the largest species of *Trichocera*) not only live in cold environment, but also mate and lay eggs under the snow cover in winter (Hågvar and Krzemińska 2007). Hence, the common name of winter crane flies is proper. The adults live in damp places close to lakes, rivers, or streams and most of them feed on plant fluids (Yang 2009); while the larvae live in moist or wet or terrestrial biotopes and feed on plant debris, decaying leaves in forests, mushrooms and animal droppings (Dahl and Alexander 1976) or take cankered plants or animal bodies as food (Yang 2009).

There are 77 species of fossil and amber trichocerids, which have been assigned into three subfamilies: Trichocerinae, Paracladurinae and Kovalevinae; and twelve genera: *Cladoneura* Scudder, 1894; *Eotrichocera* Kalugina, 1985; *Rasnitsynina* Krzemińska, Krzemiński & Dahl, 2009; *Mailotrichocera* Kalugina, 1985; *Paleotrichocera* Kalugina, 1986; *Karatina* Krzemińska, Krzemiński, Dahl & Lukashevich, 2009; *Trichocera* Meigen, 1803; *Tanyochoreta* Zhang, 2006; *Zherikhinina* Krzemińska, Krzemiński & Dahl, 2009; *Undaya* Krzemińska, Krzemiński & Dahl, 2009; *Kovaleva* Krzemińska, Krzemiński & Dahl, 2009; *Paracladura* Brunetti, 1911 (Krzemińska et al. 2009a). The oldest species of trichocerids, *Mailotrichocera variabilis*, *M. mikereichi* and *M. zessini* have been described from Lower Jurassic of Germany (Krzemińska et al. 2009a).

Among them, there are eight species in three genera described from the Daohugou locality of China: *Eotrichocera* (*Archaeotrichocera*) *ephemera* Zhang, 2006; *Tanyochoreta integera* Zhang, 2006; *Tanyochoreta chifengica* Zhang, 2006; *Tanyochoreta* (*Sinotrichocera*) *parva* Zhang, 2006; *Eotrichocera* (*Archaeotrichocera*) *conica* Krzemińska, Krzemiński & Ren, 2009; *Eotrichocera* (*Archaeotrichocera*) *rara* Krzemińska, Krzemiński & Ren, 2009; *Eotrichocera* (*Archaeotrichocera*) *spatiosa* Liu, Shih & Ren, 2012 and *Zherikhinina reni* Krzemińska, Krzemiński & Dahl, 2009.

Furthermore, *Sinotrichocera* Zhang, 2006 has been changed as a subgenus belonging to *Tanyochoreta; Oligotrichocera* Dahl, 1971 as a subgenus belonging to *Trichocera* Podenas, 2001; *Trichonomites* Kalugina, 1986 and *Paleotrichocera* Kalugina, 1986 are synonymized (Krzemińska et al. 2009a). All genera and species of Trichoceridae Kertész, 1902, after revisions and transfers, are summarized in Table 1, which is updated and expanded from the Tables 1 and 4 in Krzemińska et al. 2009a.

The specimens for this study were collected from the Jiulongshan Formation of the Daohugou Village in Inner Mongolia, China. The Daohugou fossil-bearing beds are considered as the late Middle Jurassic (Bathonian-Callovian boundary, 165 Mya) (Ren et al. 2002; Gao and Ren 2006; Ren et al. 2010a; Shi et al. 2011). Daohugou is one of the localities where the fossils of Yanliao biota were distributed. A huge number of fossil insects have been reported (Ren and Engel 2007; Engel and Ren 2008; Liu and Ren 2008; Ren et al. 2009; Wang and Ren 2009; Gu et al. 2010; Ren et al. 2010b; Wang et al. 2010; Wang et al. 2012; Yang et al. 2012).

Table 1. Fossil species of Trichoceridae Kertész, 1902.

Genus	Species	Author(s)	Date	Age	Locality
Cladoneura	*C. willistoni*	Scudder	1894	Lower Oligocene	Florissant, USA
Eotrichocera (*Archaeotrichocera*)	*E. (A.) ephemera*	Zhang	2006	Middle Jurassic	Daohugou, China
	E. (A.) conica	Krzemińska, Krzemiński & Ren	2009a	Middle Jurassic	Daohugou, China
	E. (A.) rara	Krzemińska, Krzemiński & Ren	2009a	Lower Cretaceous	Kempendyay, Russia
	E. (A.) spatiosa	Liu, Shih & Ren	2012a	Middle Jurassic	Daohugou, China
Eotrichocera (*Eotrichocera*)	*E. (E.) christinae*	Kalugina	1985	Lower Jurassic or earlier Middle Jurassic	Novospasskoe, Russia
Karatina	*K. longipes*	Rohdendorf	1964	Upper Jurassic	Karatau, Kazakhstan
	K. explorans	Krzemińska, Krzemiński, Dahl & Lukashevich	2009a	Lower Cretaceous	Baissa, Russia
	K. pellita	Krzemińska, Krzemiński, Dahl & Lukashevich	2009a	Upper Jurassic	Karatau, Kazakhstan
Kovaleva (*Kovaleva*)	*K. (K.) fragmentosa*	Krzemińska, Krzemiński & Dahl	2009a	Jurassic/Cretaceous boundary	Unda and Daya, E. Transbaikalia
	K. (K.) hirsuta	Krzemińska, Krzemiński & Dahl	2009a	Jurassic/Cretaceous boundary	Daya, E. Transbaikalia
	K. (K.) obscura	Krzemińska, Krzemiński & Dahl	2009a	Jurassic/Cretaceous boundary	Daya, Unda and Shevia, E. Transbaikalia
	K. (K.) sheviae	Krzemińska, Krzemiński & Dahl	2009a	Jurassic/Cretaceous boundary	Shevia, E. Transbaikalia
	K. (K.) volodii	Krzemińska, Krzemiński & Dahl	2009a	Jurassic/Cretaceous boundary	Daya, E. Transbaikalia
Kovaleva (*Vladimirevna*)	*K. (V.) mirabilis*	Krzemińska, Krzemiński & Dahl	2009a	Jurassic/Cretaceous boundary	Daya, E. Transbaikalia
Mailotrichocera	*M. jurassica*	Kalugina	1985	Uppermost middle or earliest Upper Jurassic	Uda, E. Transbaikalia
	M. gracilis	Krzemińska, Krzemiński & Dahl	2009a	Jurassic/Cretaceous boundary	Daya, Unda and Shevia, E Transbaikalia
	M. mikereichi	Krzemińska, Krzemiński & Ansorge	2009a	Lower Jurassic	Dobbertin, Germany; Grimmen, Germany
	M. ovifera	Krzemińska, Krzemiński & Dahl	2009a	Jurassic/ Cretaceous boundary	Unda, E. Transbaikalia
	M. prisca	Krzemińska, Krzemiński & Dahl	2009a	Jurassic/Cretaceous boundary	Unda and Shevia, E. Transbaikalia
	M. sukachevae	Krzemińska, Krzemiński & Dahl	2009a	Jurassic/Cretaceous boundary	Unda, E Transbaikalia
	M. variabilis	Krzemińska, Krzemiński & Ansorge	2009a	Lower Jurassic	Dobbertin, Germany; Grimmen, Germany
	M. zessini	Krzemińska, Krzemiński & Ansorge	2009a	Lower Jurassic	Grimmen, Germany
Paleotrichocera	*P. mongolica*	Kalugina	1986	Lower Cretaceous	Gurvan Erenyi Nuru, Mongolia
Paracladura	*P. caucasiana*	Krzemińska, Krzemiński & Dahl	2009a	Middle Miocene	Stavropol, Caucasus

Genus	Species	Author(s)	Date	Age	Locality
Rasnitsynina	*R. collecta*	Krzemińska, Krzemiński & Dahl	2009a	Jurassic/Cretaceous boundary	Shevia, E. Transbaikalia
	R. minae	Krzemińska, Krzemiński & Dahl	2009a	Jurassic/Cretaceous boundary	Shevia and Daya, E Transbaikalia
Tanyochoreta (*Sinotrichocera*)	*T.* (*S.*) *parva*	Zhang	2006	Middle Jurassic	Daohugou, China
Tanyochoreta (*Tanyochoreta*)	*T.* (*T.*) *chifengica*	Zhang	2006	Middle Jurassic	Daohugou, China
	T. (*T.*) *integera*	Zhang	2006	Middle Jurassic	Daohugou, China
Tanyochoreta (*Trichokara*)	*T.* (*T.*) *composita*	Krzemińska, Krzemiński & Dahl	2009a	Upper Jurassic	Karatau, Kazakhstan
	T. (*T.*) *fracta*	Krzemińska, Krzemiński & Dahl	2009a	Upper Jurassic	Karatau, Kazakhstan
	T. (*T.*) *minuta*	Krzemińska, Krzemiński & Dahl	2009a	Upper Jurassic	Karatau, Kazakhstan
	T. (*T.*) *tenuis*	Krzemińska, Krzemiński & Dahl	2009a	Upper Jurassic	Karatau, Kazakhstan
	T. (*T.*) *zagadka*	Krzemińska, Krzemiński & Dahl	2009a	Jurassic/Cretaceous boundary	Unda, E Transbaikalia
	T. (*T.*) *zbulwami*	Krzemińska, Krzemiński & Dahl	2009a	Jurassic/Cretaceous boundary	Daya and Unda, E Transbaikalia
Trichocera	*T. scudderi*	Meunier	1915	Upper Oligocene	Rott, Germany
	T. miocaenica	Statz	1934	Upper Oligocene	Rott, Germany
	T. antiqua	Dahl	1971	Upper Eocene	Baltic
	T. primaeva	Dahl	1971	Upper Eocene	Baltic
	T. fujiyamai	Gentilini	1984	Upper Miocene	Monte Castellaro, Italy
	T. anbar	Podenas	2001	Upper Eocene	Baltic
	T. bona	Podenas	2001	Upper Eocene	Baltic
	T. cerea	Podenas	2001	Upper Eocene	Baltic
	T. diluta	Podenas	2001	Upper Eocene	Baltic
	T. ebenos	Podenas	2001	Upper Eocene	Baltic
	T. christelae	Krzemińska, Krzemiński & Dahl	2009a	Upper Eocene	Baltic
	T. corami	Krzemińska, Krzemiński & Dahl	2009a	Lower Cretaceous	Purbeck, UK
	T. cretacea	Krzemińska, Krzemiński & Dahl	2009a	Lower Cretaceous	Baissa, Russia
	T. hanswerneri	Krzemińska, Krzemiński & Dahl	2009a	Upper Eocene	Baltic
	T. turgana	Krzemińska, Krzemiński & Dahl	2009a	earlier Lower Cretaceous	Turga, E. Transbaikalia
Undaya	*U. alata*	Krzemińska, Krzemiński & Dahl	2009a	Jurassic/Cretaceous boundary	Unda and Shevia, E. Transbaikalia
	U. comis	Krzemińska, Krzemiński & Dahl	2009a	Jurassic/Cretaceous boundary	Unda, E. Transbaikalia
	U. gargantuina	Krzemińska, Krzemiński & Dahl	2009a	Jurassic/Cretaceous boundary	Daya and Unda, E. Transbaikalia
	U. hilara	Krzemińska, Krzemiński & Dahl	2009a	Jurassic/Cretaceous boundary	Unda and Shevia, E. Transbaikalia
	U. kaluginae	Krzemińska, Krzemiński & Dahl	2009a	Jurassic/Cretaceous boundary	Daya, E. Transbaikalia
	U. lenae	Krzemińska, Krzemiński & Dahl	2009a	Upper Jurassic	Shar-Teg, Mongolia

Genus	Species	Author(s)	Date	Age	Locality
	U. lukashevichae	Krzemińska, Krzemiński & Dahl	2009a	Upper Jurassic	Shar-Teg, Mongolia
	U. maxima	Krzemińska, Krzemiński & Dahl	2009a	Lower Cretaceous	Kempendyay, Russia
	U. mitis	Krzemińska, Krzemiński & Dahl	2009a	Jurassic/Cretaceous boundary	Daya and Unda, E. Transbaikalia
	U. molesta	Krzemińska, Krzemiński & Dahl	2009a	Jurassic/Cretaceous boundary	Unda and Daya, E. Transbaikalia
	U. namdyriensis	Krzemińska, Krzemiński & Dahl	2009a	Lower Cretaceous	Kempendyay, Russia
	U. parvula	Krzemińska, Krzemiński & Dahl	2009a	Jurassic/Cretaceous boundary	Daya and Unda, E. Transbaikalia
	U. pura	Krzemińska, Krzemiński & Dahl	2009a	Jurassic/Cretaceous boundary	Unda and Daya, E. Transbaikalia
	U. salsa	Krzemińska, Krzemiński & Dahl	2009a	Lower Cretaceous	Kempendyay, Russia
	U. savina	Krzemińska, Krzemiński & Dahl	2009a	Jurassic/Cretaceous boundary	Savina, E. Transbaikalia
	U. saxea	Krzemińska, Krzemiński & Dahl	2009a	Lower Cretaceous	Kempendyay, Russia
	U. triangula	Krzemińska, Krzemiński & Dahl	2009a	Lower Cretaceous	Kempendyay, Russia
Zherikhinina	*Z. itatica*	Kalugina	1985	Middle Jurassic	Kubekovo, Russia
	Z. alastos	Krzemińska & Lukashevich	2009b	Upper Jurassic	Shar Teg, Mongolia
	Z. baissana	Krzemińska, Krzemiński & Dahl	2009a	Lower Cretaceous	Baissa, Russia
	Z. bontsagana	Krzemińska, Krzemiński & Dahl	2009a	Lower Cretaceous	Bon Tsagan, Mongolia
	Z. karatavica	Krzemińska, Krzemiński & Dahl	2009a	Upper Jurassic	Karatau, Kazakhstan
	Z. novospasskaya	Krzemińska, Krzemiński & Dahl	2009a	later Lower or early Middle Jurassic	Novospasskoe, Russia
	Z. reni	Krzemińska, Krzemiński & Dahl	2009a	Middle Jurassic	Daohugou, China
	Z. tola	Krzemińska, Krzemiński & Dahl	2009a	Lower Cretaceous	Onokhoy, Mongolia
	Z. zherikhini	Krzemińska, Krzemiński & Dahl	2009a	Upper Jurassic	Karatau, Kazakhstan

Materials and methods

The wing venation nomenclature used in this paper is based on the interpretations and system proposed by Lukashevich (2004) and Krzemińska et al. (2009a). The fossil specimens were examined under a Leica MZ7.5 dissecting microscope and illustrated with the aid of a drawing tube attachment. Line drawings were prepared with Adobe Photoshop CS3 Extended graphics software.

All specimens studied in the paper are housed in the Key Lab of Insect Evolution and Environmental Changes, College of Life Sciences, Capital Normal University, Beijing, China.

Systematic paleontology

Family Trichoceridae Kertész, 1902
Genus *Eotrichocera* Kalugina, 1985

Subgenus *Archaeotrichocera* Krzemińska, Krzemiński & Dahl, 2009

Type species. *Eotrichocera* (*Archaeotrichocera*) *ephemera* Zhang, 2006

Other included species. *Eotrichocera* (*Archaeotrichocera*) *conica* Krzemińska, Krzemiński & Ren, 2009; *Eotrichocera* (*Archaeotrichocera*) *rara* Krzemińska, Krzemiński & Ren, 2009; *Eotrichocera* (*Archaeotrichocera*) *spatiosa* Liu, Shih & Ren, 2012.

Key to the species of *Eotrichocera* (*Archaeotrichocera*)

1 Sc ending at anterior margin distad of R_2 ..... **2**
– Sc ending at anterior margin proximad of R_2 ..... **3**
2 Large size (wing length 12.0 mm) .....
..... ***E.* (*A.*) *spatiosa* Liu, shih & Ren, 2012 (Daohugou, J_2)**
– Medium size (wing length 5.5 mm) .....
..... ***E.* (*A.*) *rara* Krzemińska, Krzemiński & Ren, 2009 (Daohugou, J_2)**
3 Crossvein sc-r distad of 1/2 (at 2/3) of length of Rs **4**
– Crossvein sc-r proximad of or at 1/3 of length of Rs **5**
4 Rs forking distad of 2/3 (at 0.77) times of wing length .....
..... ***E.* (*A.*) *ephemera* Zhang, 2006 (Daohugou, J_2)**
– Rs forking proximad of 2/3 (at about 0.53) times of wing length.....
..... ***E.* (*A.*) *longensis* sp. n. (Daohugou, J_2)**
5 A_2 long (0.22 times as long as wing), d cell narrow and long (W/L=0.43 .....
..... ***E.* (*A.*) *conica* Krzemińska, Krzemiński & Ren, 2009 (Daohugou, J_2)**
– A_2 short (0.13 times as long as wing), d cell broad (W/L=0.58) .....
..... ***E.* (*A.*) *amabilis* sp. n. (Daohugou, J_2)**

Eotrichocera (*Archaeotrichocera*) *longensis* sp. n.

http://zoobank.org/8A0D358E-7BCA-476B-A0A9-6EECA93FCBA8
http://species-id.net/wiki/Eotrichocera_longensis

Etymology. "*longensis*" is a Latin word, referring to the long leg of this specimen.

Diagnosis. Sc rather short about 0.65 times as long as the wing and ending at anterior margin proximad of R_2; Rs forking proximad of 2/3 (at about 0.55) times of wing length; the d-cell narrow and long (about 2.5 times as long as wide); A_2 short and bending sharply toward anterior margin (angle about 128°).

Holotype. An almost complete female specimen with well-preserved body, wings and head. Specimen number CNU-DIP-NN2013133. Wing length 9.0 mm, width 3.8 mm (Figs 1A, 2, 3A).

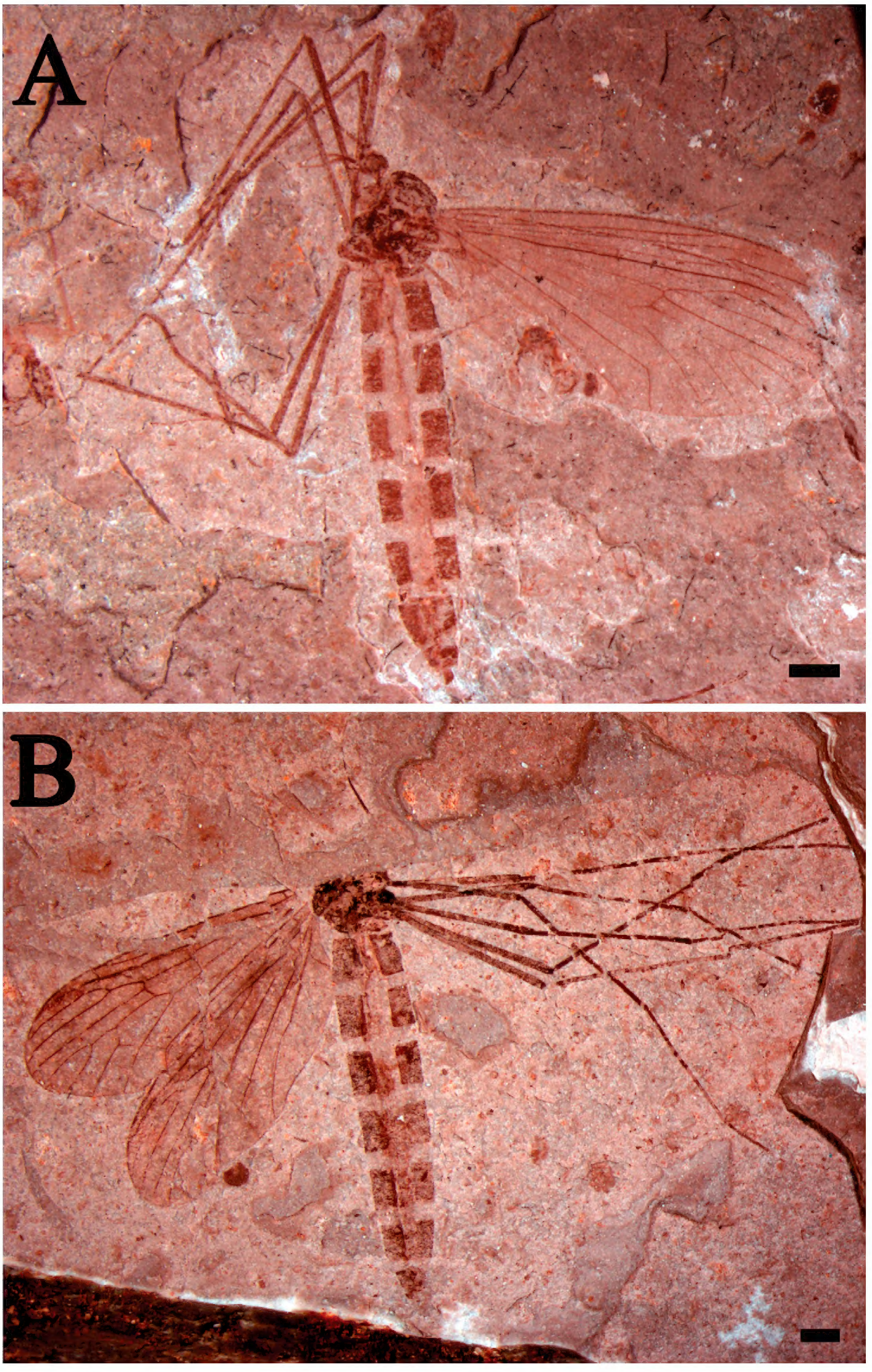

Figure 1. *Eotrichocera* (*Archaeotrichocera*) *longensis* sp. n. Holotype, specimen CNU-DIP-NN2013133 **A** Photograph. Paratype, specimen CNU-DIP-NN2013131 **B** Photograph. Scale bars = 1 mm.

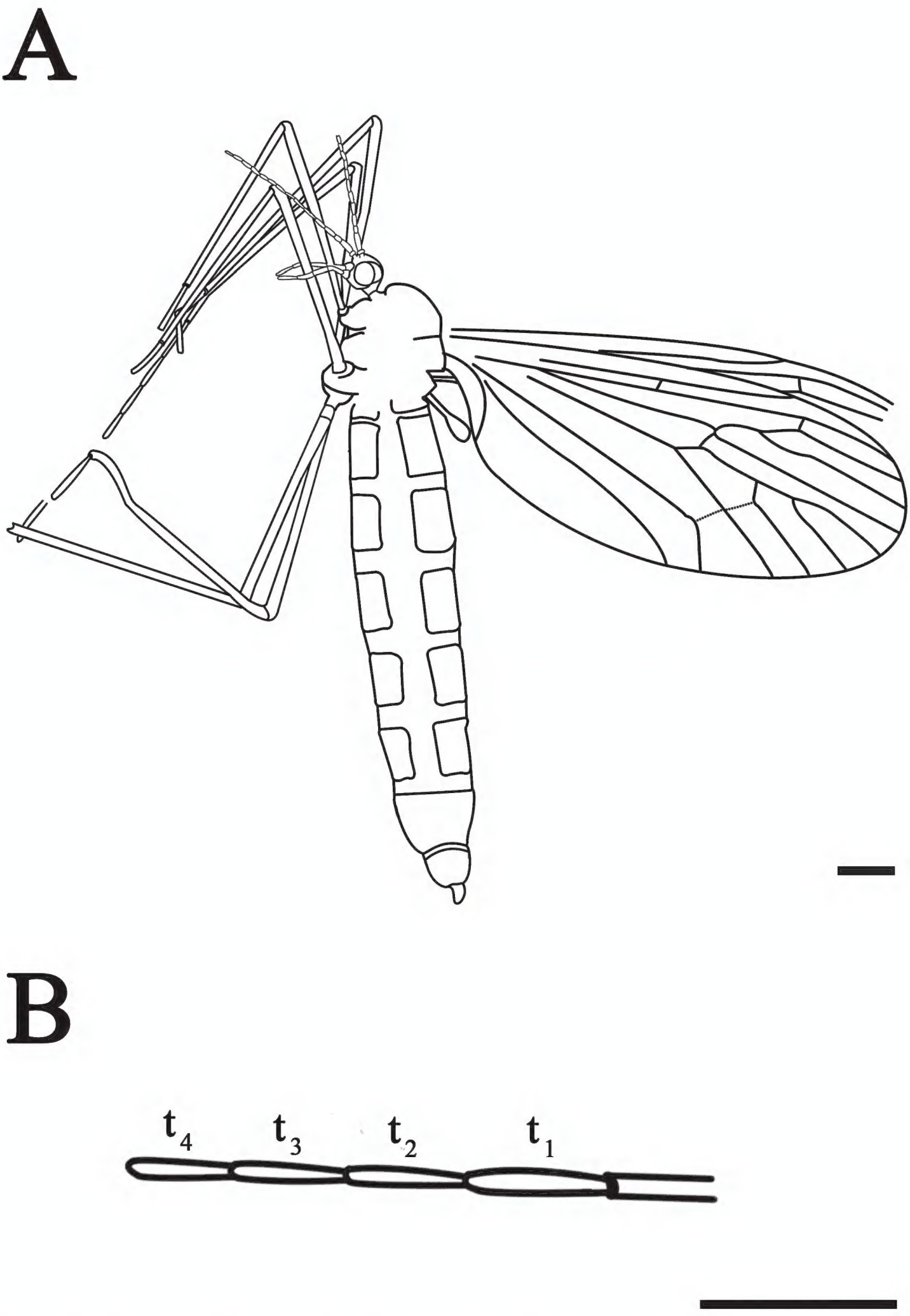

Figure 2. *Eotrichocera* (*Archaeotrichocera*) *longensis* sp. n. Holotype, specimen CNU-DIP-NN2013133 **A** Line drawing **B** Tarsus of the mid leg. Scale bars = 1 mm; t_1 = the first segment of tarsus; t_2 = the second segment of tarsus; t_3 = the third segment of tarsus; t_4 = the fourth segment of tarsus.

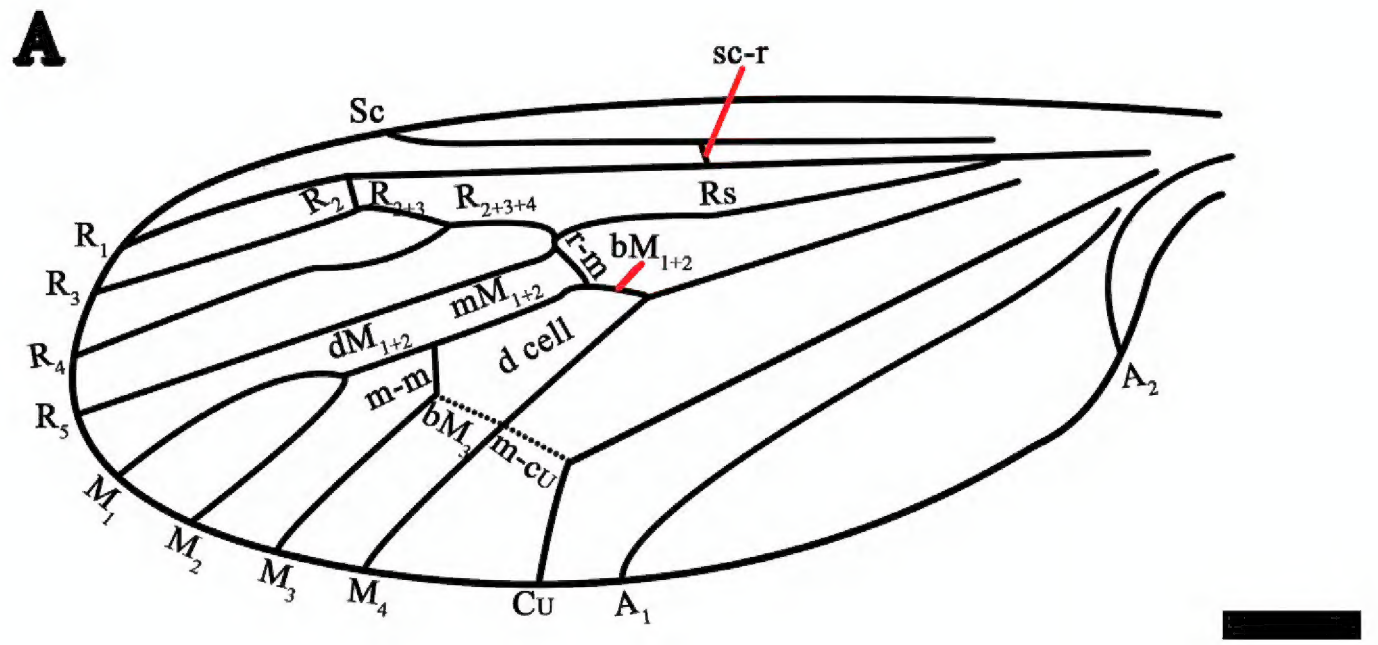

Figure 3. *Eotrichocera* (*Archaeotrichocera*) *longensis* sp. n. Holotype, specimen CNU-DIP-NN2013133 **A** Line drawing of left wing. Paratype, specimen CNU-DIP-NN2013131 **B** Line drawing of left wing. Scale bars = 1 mm

Paratype. A female specimen with body and wings, specimen number CNU-DIP-NN2013131. Wing length 7.7 mm, width 3 mm (Figs 1B, 3B).

Locality and horizon. Jiulongshan Formation, Late Middle Jurassic, Daohugou Village, Ningcheng County, Inner Mongolia Autonomous Region, China.

Description. Based on Holotype, different characters of the paratype CNU-DIP-NN2013131 in brackets. Medium-sized winter crane flies, body length (including head) 13 mm with well preserved wings, body and head, [paratype body length (excluding head) 10.5 mm].

Head: Antenna very long, about 3.5 times as long as the head length, palpi about two times as long as the head length, compound eyes preserved.

Table 2. Comparison of key characters among the two new species and other species of *Eotrichocera* (*Archaeotrichocera*) Krzemińska, Krzemiński & Dahl, 2009. L/W = ratio of length/width; W/L = ratio of width/length.

Key characters	***E.* (*A.*) *ephemera* Zhang, 2006**	***E.* (*A.*) *conica* Krzemińska, Krzemiński & Ren, 2009**	***E.* (*A.*) *rara* Krzemińska, Krzemiński & Ren, 2009**	***E.* (*A.*) *spatiosa* Liu, Shih & Ren, 2012**	***E.* (*A.*) *longensis* sp. *n.***	***E.* (*A.*) *amabilis* sp. *n.***
Wing length, in mm and (L/W)	7.1 (L/W=2.8)	10.0 (L/W=3)	5.5	12.0 (L/W=2.7)	9.0 (L/W=2.3)	5.2 (L/W=2.2)
Sc length and ending at anterior margin	0.77 times of wing length, ending proximad of R_2	0.71 times of wing length, ending proximad of R_2	0.77 times of wing length, ending distad of R_2	0.84 times of wing length, and ending distad of R_2	about 0.65 times of wing length, ending proximad of R_2	about 0.71 times of wing length, ending proximad of R_2
sc-r position	at 2/3 of length of Rs	at 1/3 of length of Rs	at 1/2 of length of Rs	at 2/3 of length of Rs	at 2/3 of length of Rs	at 1/3 of length of Rs
Position of Rs forking	0.77 times of wing length	0.64 times of wing length	0.57 times of wing length	0.58 times of wing length	0.53 times of wing length	0.55 times of wing length
d-cell W/L (length)	W/L=0.53 (1/6 of wing length)	W/L=0.43 (0.2 times of wing length)	W/L=0.39 (0.21 times of wing length)	W/L=0.47 (0.19 times of wing length)	W/L= 0.4 (almost 1/5 of wing length)	W/L=0.58 (almost 0.17 of wing length)
A_2 length	long (about 1/4 of wing length), curved evenly to posterior margin	medium (0.22 times of wing length), not reaching posterior margin	rather short (1/5 of wing length) and not reaching posterior margin	short (about 0.21 times of wing length) and curving to posterior margin	short (0.14) times of wing length) and curved to posterior margin	short (0.13) times of wing length) and curved to posterior margin
r-m length	.....	1/5 of length of d-cell	.....	about 1/3 of length of d-cell	1/5 of length of the d-cell	0.24 or 0.15 of length of the d-cell

Thorax: Much higher, in lateral view, than that of the abdomen, subcircular in shape, with robust and well-developed mesonotum. The halters spoon-type and the length of halters as long as thorax.

Wings: Wing is shorter than abdomen, not covering the end of the abdomen. Length 9.0 mm [Paratype with wing length of 7.7 mm], narrow and long (about 2.5 times as long as wide); venation clear, Sc rather short about 0.68 times as long as the wing [Paratype Sc rather short, about 0.65 times as long as the wing] and ending at anterior margin proximad of R_2; crossvein sc-r locating at 2/3 of Rs; Rs arising about one-fifth from the base of the wing; R_{2+3} about 0.8 times as long as R_{2+3+4}; R_2 about one-tenth of length of R_3; R_3 almost three times as long as the R_{2+3}; dM_{1+2} 0.6 times as long as mM_{1+2}, while M_1 2.5 times of the dM_{1+2}; a well developed m-m crossvein about three-fourth length of bM_3, closing the d-cell and nearly 0.3 length of d-cell; bM_{1+2} nearly 1.0 times as long as the length of the r-m and the latter at one-fifth of the d-cell; d-cell narrow and long (about 2.5 times as long as wide) and almost one-fifth length of wing; both crossveins m-m and m-cu intersecting with M_4 at the same point; Cu long, curved (angle about 135°) and reaching the wing posterior margin at 0.6 from the base of the wing; the stem of A divided into A_1 and A_2; A_1 long, slightly curving and reaching the wing posterior margin; A_2 short, 0.15 (right wing) [Paratype 0.14] times as long as

wing and almost 0.3 times as long as length of A_1, bending sharply (angle about 128°) and reaching the wing posterior margin.

Legs: Legs slender and long; the hind leg nearly 1.2 times as long as the abdomen and 1.3 times as long as the wing. Tarsus with five segments; the first segment of tarsus (t_1) is 1.2 times as long as t_2 in mid leg.

Abdomen: Abdomen relatively long and thin, with ten segments. Female genital discernible.

Remarks. *Eotrichocera* (*Archaeotrichocera*) *longensis* sp. n. is assigned to Trichocerinae based on the following characters: d-cell medium, m-cu present; A_2 short, antennae long, flagellomeres thin, much longer than two times of the head length. It belongs to *Eotrichocera* (*Archaeotrichocera*) because of wing length from 7.7 to 9.0 mm and d-cell almost one-fifth of wing length. In addition, it differs from all other known Trichocerinae by its A_2 rather short and bending sharply toward anterior margin (angle about 128°), R_2 relatively long, Sc forking proximad of 2/3 (at about 0.55) times of wing length, and d-cell narrow and long. To compare the key characters among the new species and other species of *Eotrichocera* (*Archaeotrichocera*), we set up the Table 2.

***Eotrichocera* (*Archaeotrichocera*) *amabilis* sp. n.**

http://zoobank.org/D32A4E4B-EDF1-4684-802E-92F9617DEAB2

http://species-id.net/wiki/Eotrichocera_amabilis

Etymology. The specific name of "*amabilis*" is a Latin word, meaning lovely.

Diagnosis. Body small and wing short; Sc 0.71 times as long as wing; the d-cell broad (about 1.7 times as long as wide); A_2 short and bending sharply toward posterior margin (angle about 128°).

Holotype. An almost complete female specimen with well-preserved body, wings and head. Specimen number CNU-DIP-NN2013134, Wing length 5.2 mm, width 2.2 mm (Figs 4A–D, 5A, 6).

Paratype. A specimen with body and wings with partial venation, specimen number CNU-DIP-NN2013132, (Figs 4E, 5B).

Locality and horizon. Jiulongshan Formation, Late Middle Jurassic, Daohugou Village, Ningcheng County, Inner Mongolia Autonomous Region, China.

Description. Based on Holotype, different characters of the paratype CNU-DIP-NN2013132 in brackets. Medium-sized winter crane flies, head length 0.47 mm, body length (including head) 5.8 mm with well preserved body and wings. [Paratype with partial body and wings with partial venation].

Head: antenna very long, about 5.7 times as long as the head length, palpi about two times as long as the head length, compound eyes preserved (Figs 4C, 6).

Thorax: Much higher, in lateral view, than that of the abdomen, subcircular in shape, with robust and well-developed mesonotum.

Wings: Wing is shorter than abdomen, not covering the end of the abdomen. Wing length of 5.2 mm [Paratype with wing length 5.0 mm], narrow and long (L/W=2.2); ve-

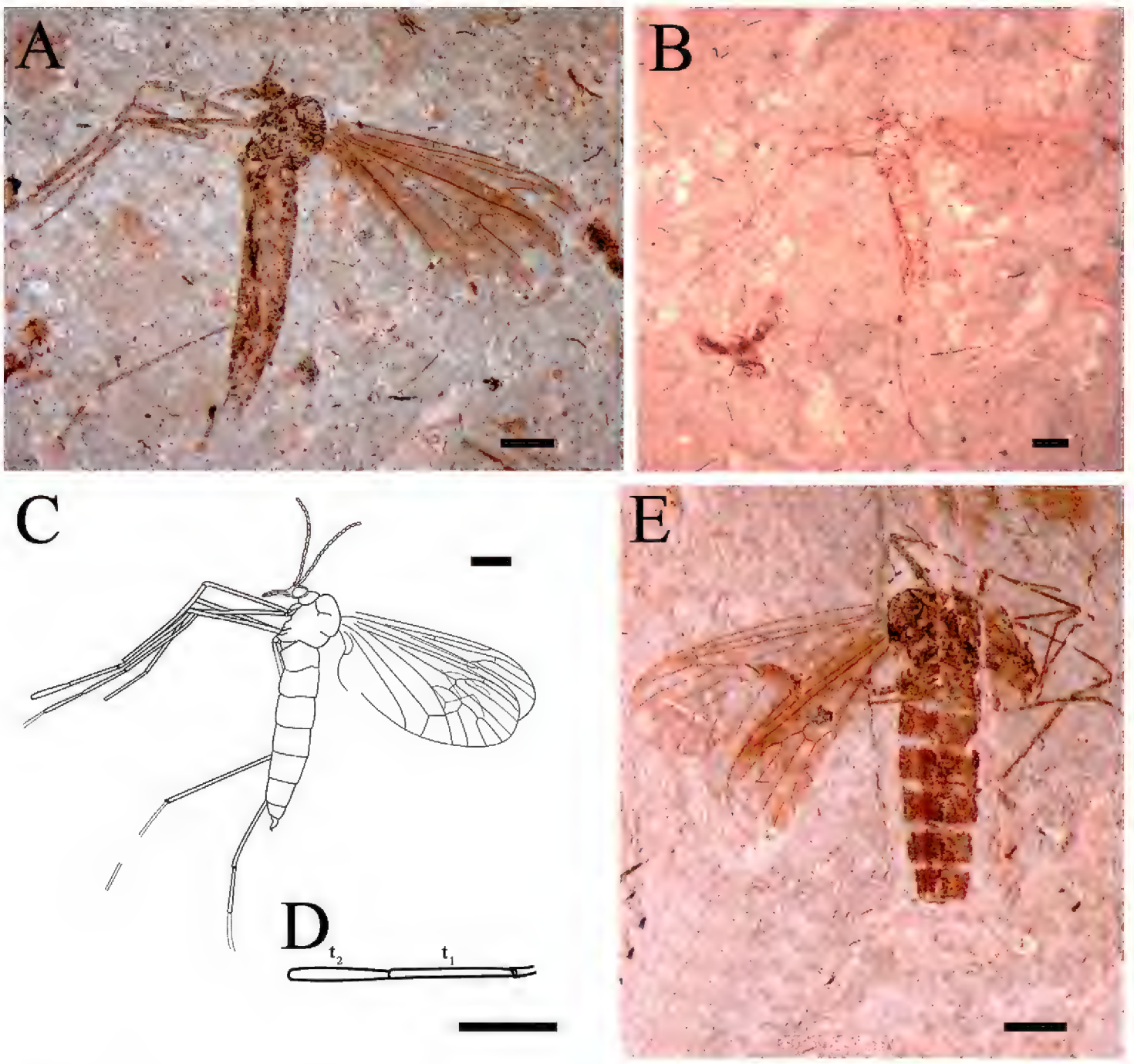

Figure 4. *Eotrichocera* (*Archaeotrichocera*) *amabilis* sp. n. Holotype, specimen CNU-DIP-NN2013134 **A** Photograph **B** Photograph, under alcohol **C** Line drawing **D** Tarsus of the mid leg. Paratype, specimen CNU-DIP-NN2013132 **E** Photograph. Scale bars = 1 mm; t_1 = the first segment of tarsus; t_2 = the second segment of tarsus.

nation clear, Sc rather short about 0.71 times as long as the wing and terminating clearly proximad of R_2; crossvein sc-r locating at 1/3 [Paratype 1/2] of Rs, and distad to the Sc ending; [Paratype Rs arising about one-fourth from the base of the wing]; Rs forking at 0.55 [Paratype 0.64] times of wing length; R_{2+3} about 1.9 times as long as R_{2+3+4}; R_2 about 0.18 of length of R_3; R_3 almost 3.7 times as long as the R_{2+3}; R_5 9.0 times as long as R_{2+3+4}; M_1 1.6 times of the dM_{1+2}; crossvein m-m well developed about 0.73 times as long as bM_3, closing the d-cell and nearly 0.17 [Paratype 0.21] times as long as wing; bM_{1+2} nearly 2.1 times as long as the length of the r-m and the latter at one-fourth of the d-cell; d-cell broad (W/L=0.58 [Paratype 0.56]) and almost 0.17 times of length of wing; Cu long, curved (angle about 121°) and reaching the wing posterior margin at 0.67 from the base of the wing; the stem of A divided into A_1 and A_2; A_1 long, slightly curving and

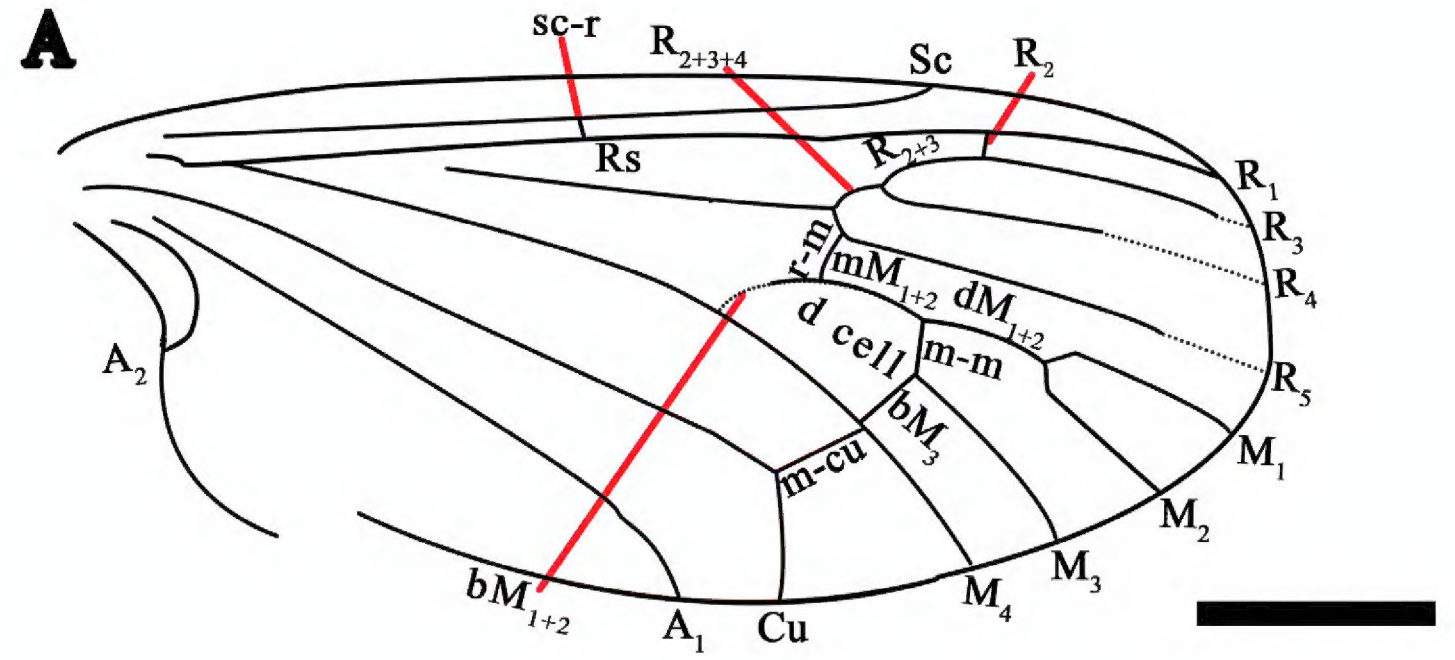

Figure 5. *Eotrichocera* (*Archaeotrichocera*) *amabilis* sp. n. Holotype, specimen CNU-DIP-NN2013134 **A** Line drawing of left wing. Paratype, specimen CNU-DIP-NN2013132 **B** Line drawing of left wing. Scale bars = 1 mm.

reaching the wing posterior margin; A_2 short, 0.13 times as long as wing and almost 0.25 times as long as length of A_1, bending sharply and reaching the wing posterior margin.

Abdomen: Abdomen relatively long and thin, with ten segments. Female genitalia discernible (Figs 4A–C) [Paratype genitalia indiscernible].

Legs: Legs slender and long; the hind leg nearly 1.5 times as long as the abdomen and 1.4 times as long as the wing. Tarsus with five segments; the first segment of tarsus (t_1) is 1.2 times as long as t_2 in mid leg.

Remarks. The new species is compared and differentiated from all other species in *Eotrichocera* (*Archaeotrichocera*) in Table 2.

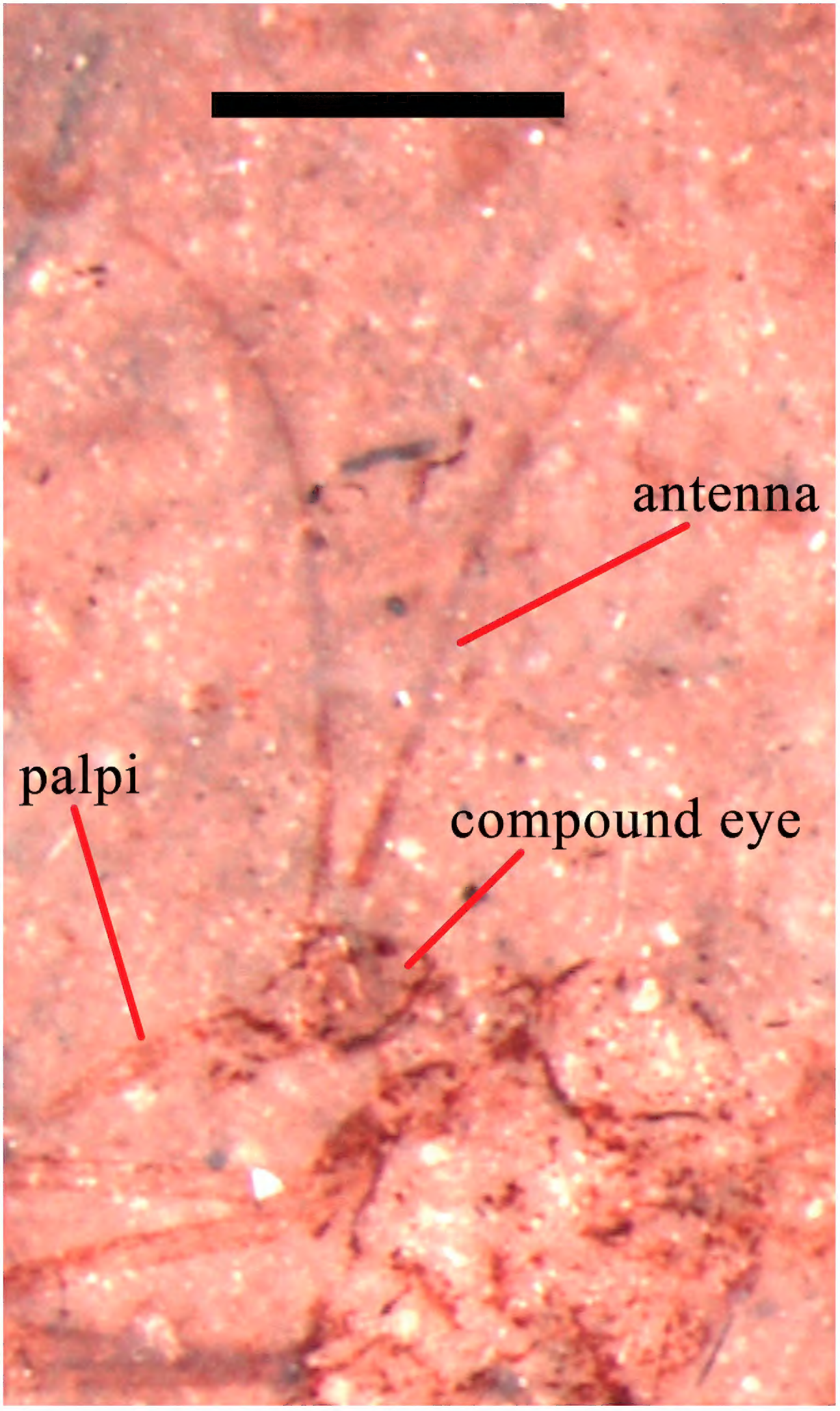

Figure 6. *Eotrichocera* (*Archaeotrichocera*) *amabilis* sp. n. Holotype, specimen CNU-DIP-NN2013134, Photograph of head, under alcohol. Scale bar = 1 mm.

Due to limitation of fossil preservation, some of the morphological characters of previously described fossil are not objective or clear. We set up an aforementioned key based on the Sc length and ending location at anterior margin, wing length, crossvein sc-r position, Rs forking location and A_2 length, to differentiate the species of subgenus *Archaeotrichocera*. These characters may help future morphological and taxonomic studies in differentiating fossil species of Trichoceridae.

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